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RECOMMENDATIONS FOR REDUCTION AND CONTROL OF SALMONELLOSIS

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REPORT OF THE U.S. ADVISORY COMMITTEE ON SALMONELLA

JANUARY 1978
FOOD SAFETY AND QUALITY SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

PREFACE

The problem of salmonella contamination of the meat and poultry supply has existed probably for as long as man has been using animals for food. The U.S. Department of Agriculture, the Food and Drug Administration, and the food industry have attempted to attack this problem many times in various ways. The complexity of the problem is underscored by the fact that, despite the best efforts of all of these groups, salmonella infection in the meat and poultry food supply is still occurring.

To study the problem and to make specific recommendations on how to reduce the incidence of salmonellosis, the Secretary of Agriculture named a committee representing all segments of the involved industries, governments, and consumers.

The Advisory Committee on Salmonella was authorized by Secretary's Memorandum No. 1886, dated November 12, 1975 (see appendix A). The committee organized itself into six subcommittees to work on these areas: feed and feed ingredients, breeders and hatcheries, production, processing, consumer education, and research. Each subcommittee operated relatively autonomously to meet with experts in its area of interest and to make recommendations to the full committee. This report is divided into these six areas for clarity. However, the committee wishes to emphasize that the report should be considered in total and implemented accordingly.

The recommendations in this report were adopted by unanimous consent of the committee members and are to be presented to the Secretary of Agriculture as points of suggested action by industry, consumers, and government.

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RECOMMENDATIONS FOR REDUCTION AND CONTROL OF SALMONELLOSIS

REPORT OF THE U.S. ADVISORY COMMITTEE ON SALMONELLA

SUMMARY

The recommendations of the Advisory Committee on Salmonella fall into three broad categories: assessment of salmonella incidence under present practices, procedures that can be implemented using present technology, and areas for future research.

A benchmark study of the present incidence of salmonella in all phases of the meat and poultry food chain is recommended to provide a gauge by which to judge the effects of any changes that are made in that food chain. Specific recommendations for change--intended to decrease the incidence of salmonella in humans, livestock, poultry and our total environment--are:

- * Reduction of salmonella in breeding stocks and hatching eggs.
- * Hygienic management of livestock and poultry including salmonella decontamination of, and security practices for, buildings and equipment, rotation of ranges, when possible; and reduction of stress on animals destined for slaughter.
- * Production of a salmonella-negative feed supply. This is an immediate goal for breeders and hatcheries and a long range goal for the entire industry. It will involve (1) an educational effort to inform the industries involved of the steps necessary to reach this goal, (2) availability or option of certification for recognition and incentive purposes, and (3) research to develop information on pelletizing feeds and on salmonella inhibitors, such as chemicals and various types of pasteurization.
- * Establishment of a cadre of salmonella epidemiologists for periodic monitoring of salmonella and for confirmation of infections by laboratory testing and serotyping necessary to detect and elucidate epidemic patterns of salmonellosis. Research is recommended to develop a rapid, simple, mass-screening test for salmonella; to study practical prevention of salmonella infections in poultry and livestock; and to study the relationship of sampling plans to the prevalence of salmonellosis.

- * Reduction of cross-contamination during slaughtering and processing. This recommendation centers around improved sanitation, increased employee training, increased use of chlorine, improved equipment, better handling and trimming procedures, sequential inspection of poultry, increased use of automated cleaning equipment and development of processing guidelines.
- * Support for the development of (1) processing guidelines and model ordinances for appropriate industries and (2) certification of food-service managers.
- * Emphasis in educational programs for consumers and food handlers on the importance of food safety and decreasing salmonella contamination in the food supply. Educational materials should be developed after consultations with professionals. Mass media should be used to help educate the public.

FEED AND FEED INGREDIENTS

The Feed and Feed Ingredients Subcommittee agreed that the eradication of salmonella from feed and feed ingredients is not a realistic goal. However, there are procedures to reduce salmonella in feed, and these procedures should become part of our recommendations.

The reduction of salmonella in feed can most effectively be handled by development and implementation of sanitation guidelines.

- a. Important in this consideration are purveyors of processed soft ingredients, renderers, blenders, feed manufacturers, feed dealers, on-the-farm mixers, meat packers, milk dryers, brewers, and milkers.
- b. Voluntary inspection, in the form of industry self-monitoring programs structured under the Agricultural Marketing Act of 1946 (with some reward for industry) is definitely indicated. The programs could be modeled after the current program of the fish industry, operated by the U.S. Department of Commerce.
- c. Educational programs for all levels of industrial employees are essential. Basic principles of sanitation and hygiene should be thoroughly covered in the programs.

Antagonists (various antibacterial agents) were discussed, and at the present time, there is no strong indication that any can eliminate salmonella from feed or feed ingredients.

The influence of water on salmonella activity was reviewed. Water may be an important factor in keeping down salmonella. Too little is known in this area, and research was recommended.

Sanitation was reviewed. Too often, improper methods are used in cleaning and sanitation programs, especially: (a) there is no clean-up before disinfection; (b) water should not be used when cleaning dry areas where mechanical brushing, scraping, and vacuuming is the proper procedure. Education is important for the people who directly are involved and supervise cleaning activities. Industry should assume responsibility for providing the educational programs.

A. Recommendation. 1/

A brochure on guidelines should be prepared for the following: (a) renderers, (b) blenders, and (c) feed manufacturers. The guidelines would present "do's" and "don'ts" as suggestions rather than specific instructions that may not fit all operations. The brochure should be completed within one year.

1/ Curtailment or shortage of energy may seriously impair some of the recommendations.

B. Recommendation.

A research program should be established to identify antagonists for salmonella and how they can be used in feed ingredients and also possibly in feed. Special emphasis should be placed on formalin. Any antagonists included in the research program should be economically feasible, practical, and safe. This program should be initiated in the next fiscal year.

C. Recommendation.

Research should be implemented to identify the specific parameters of time, temperature, moisture, and pressure necessary in a pelleting and extruding operation to completely kill salmonella and other organisms. The research should be initiated in the next fiscal year.

D. Recommendation.

A rapid test is needed to identify the presence of salmonella in feed and feed ingredients. Such a test should be officially adopted for monitoring the salmonella control program.

E. Recommendation.

A benchmark or some factual information on the present status of salmonella in feed and feed ingredients should be established. The value of our recommendations then could be determined at some later date, perhaps in 3 to 5 years.

F. Recommendation.

Milling equipment manufacturers should be contacted immediately in order to increase their understanding of the salmonella problem and also that of cross-contamination by medicaments. Discussions could include the economics of new and different methods and procedures for milling.

G. Recommendation.

The representatives of railroads and other transportation firms must be made aware immediately of the current problem of unsatisfactory carriers being used to transport feeds and feed ingredients. This is an important segment in the proposed program to reduce salmonellosis in animals and man. Unless more cargo carriers of acceptable quality are available, our efforts to reduce salmonella in feeds and feed ingredients will be unsuccessful. The program needs the positive support and definitive action of the transportation industry.

BREEDERS AND HATCHERIES

The Breeders and Hatcheries Subcommittee has recommended uniform husbandry practices to the chicken and turkey industries for the purpose of reducing breeder flock and egg-borne infection. In order for these practices to contribute in a meaningful way to reduction of salmonella in consumer products, it is necessary for the production, feed manufacturing and processing segments of the poultry industry to initiate equally effective programs towards salmonella reduction.

An industrywide poultry program aimed at salmonella reduction in consumer products must be matched by a program of equal intensity and effectiveness in the red meat industries in order to avoid economic disparity in production costs and to achieve a meaningful benefit to public health.

A. Recommendation.

The goal for the breeders of meat and egg-type chickens and turkeys is to provide disease-free stock. The primary breeders are involved at all levels, but the basic concern is to lower the incidence of salmonella in parent-stock chicks and poults delivered to multipliers so that the fowl will live and produce well.

Comment.

Procedures adopted to decrease occurrence of the salmonella of special concern in poultry health also decrease the occurrence of the salmonella of concern for human health. Thus, we do not try to attack a particular species, but rather we adopt procedures which are directed against all salmonella species.

B. Recommendation.

There are ways to reduce the incidence of all salmonella to the minimum permitted by present technology. Reduction of salmonella in chicks and poults delivered to multipliers can be accomplished in the following ways:

1. Prevent introduction of salmonella to breeder flocks.
 - a) Use properly processed feeds formulated with ingredients having a low salmonella incidence. The final goal is to have feeds processed to a point where they will not infect breeder flocks with salmonella.
 - b) Deliver and distribute feed in bulk handling equipment.
 - c) Exclude visitors, or provide them with sanitized footwear and clothing.
 - d) Exclude to the maximum degree allowed by production facilities: rodents, feral birds, predators and domestic animals.
 - e) Control insect infestations.
 - f) Clean and disinfect equipment returning to or entering the farm.
 - g) Institute programs which will prevent other vehicles from introducing salmonella.

- h) Thoroughly clean and disinfect houses and facilities between old and new flocks.
 - i) Use a potable water supply.
- 2. Reduce eggshell contamination.
 - a) House chicken breeders in confined buildings with wire floors, raised slats or part slats to separate the birds from their droppings.
 - b) House turkey breeders--insofar as possible--in confined or semi-confined buildings with sanitized nesting areas and clean open pens.
 - c) Collect eggs on clean nest material or rollaway wire bottom nests, and clean egg belts or chains.
 - d) Gather eggs frequently into sanitized equipment and transport them to a clean egg-processing room.
 - e) Reduce bacteria on shells by proper fumigation with formaldehyde gas or application of liquid sanitizers.
 - f) Discard dirty eggs from the floor and ground, along with any cracked eggs.
 - g) After shell disinfection and prior to incubation, store eggs in a clean room or rooms to prevent moisture or dust from collecting on the eggs.
 - h) Set high sanitary standards for employees who handle eggs.
- 3. Reduce hatchery contamination of day-old chicks and poultts.
 - a) Prevent contamination of newly hatched offspring-processing rooms and equipment by hatch wastes, outside personnel, and vehicles. All work areas must be cleaned and disinfected after each hatch. New hatcheries must be designed and built to facilitate effective cleaning and disinfection.
 - b) Promote high standards of sanitation among personnel by use of uniforms and hand-washing facilities.
 - c) Sanitize hatching machines after transfer of eggs.
 - d) All reusable equipment, such as plastic chick or poult boxes, must be disinfected before reuse.
- 4. Inject day-old poultts with FDA-cleared antibiotics.

5. Monitor for effectiveness of salmonella-control procedures:

- a) Poultry house environment during brooding and production by taking a culture of one or more of the following: litter, dust, nest materials, egg handling equipment.
- b) Hatchery environment by taking a culture of one or more of the following: eggshells, fluff, chick and poult processing equipment.
- c) Birds themselves with one or more of the following methods: taking a culture of pips or unhatched eggs; culling chicks and poults; examining cloacal swabs; testing serologically.

Comment.

The above guidelines represent the most effective husbandry practices to attain reduction of salmonella in breeder flocks and hatching eggs.

C. Recommendation.

All of the recommended practices of the breeder-hatchery segments of the poultry industry to reduce salmonella can be adopted by 1980, except those pertaining to:

1. Salmonella reduction in feed.
2. Total housing confinement of breeders throughout their life.
3. Diagnostic facilities to carry out monitoring procedures.

Comment.

Progress toward the goal of establishing salmonella-free primary breeding stock and elimination of salmonella is dependent on additional research to learn how to:

1. Completely decontaminate feed.
2. Completely decontaminate production facilities, including buildings, equipment, and farmland range areas.
3. Completely eliminate egg transmission.

PRODUCTION

A. Recommendation.

USDA should develop a benchmark or statistically valid information on the present status of salmonella contamination in:

1. Feed ingredients.
2. Live animals and poultry, particularly just prior to slaughter.
3. Raw meat and poultry products leaving the processing plants.

Comment.

The Committee believes the above information is needed to measure the effect of other recommendations as they are implemented. This will involve a coordinated minimum study involving statisticians, meat and poultry processors, veterinarians, field representatives, and appropriate USDA planning officials.

B. Recommendation.

USDA should support the U.S. Animal Health Association in establishing salmonellosis as a reportable animal disease at best, and at least encourage further use and development of computerized reporting and data retrieval service for laboratory diagnosed outbreaks developed by VSL (Ames, Iowa) in cooperation with USAHA/AAVLD and the AAAP. The subcommittee urges Congress to appropriate to APHIS those funds necessary to:

1. Simplify and improve reporting of salmonella outbreaks.
2. Develop a quarterly epidemiology report on poultry, livestock and aquatic salmonellosis.
3. Expand current central serotyping capabilities at VSL, as well as phage-typing, antibiogram, biochemical, and other methods to afford the most precise identification of salmonella species, subtypes and strains (all three points of equal importance--each supports the others).

Comment.

Proper reporting, analysis, and typing of the salmonella problem will not be an option but rather a necessity if epidemiological investigation and research recommendations are to be properly implemented. This would also help industry in its voluntary monitoring and control programs.

C. Recommendation.

The Committee urges Congress to appropriate funds for a cadre of veterinary salmonella epidemiologists from Veterinary Services (USDA, APHIS) to work with State veterinarians on field epidemiological sampling and investigations. The Committee recommends implementation within 2 years and would provide assistance as requested.

Comment.

Such epidemiological investigations will reveal why some farms or areas have had problems and others have not. The Committee strongly believes this kind of information will aid in speeding the development of the most realistic control recommendations and elucidate important patterns of dissemination of infection. The Committee recognizes a general attitude (among livestock producers and occasionally among poultry producers) that questions the existence of a salmonella problem warranting specific actions and strong recommendations. The Committee views the recommendations for veterinary epidemiologic sampling and investigations as an important prelude to the identification of problem areas and situations and more specific guidelines. An alternative would be to research the situation with a trial-and-error approach to finding the problems. The Committee believes epidemiology studies with proper investigations, reporting, and analysis provide a more positive and more economical approach.

D. Recommendation.

The following outline of suggestions should be recommended to all livestock and poultry producers as guides that will help reduce the incidence of salmonella and other disease conditions.

Purpose:

This outline presents promising suggestions for the reduction of salmonella contamination of livestock and poultry grown for slaughter rather than specific instructions which may not fit all operations. It is not an eradication program. It is not expected that all parts would go into effect now. Additionally, industrymen would need to monitor for salmonella in their product and choose those methods which--according to their experiences, epidemiological investigations and research projects--produce the most significant impact on reduction.

The suggestions are listed roughly in the order of their current promise to help prevent and reduce salmonella in livestock and poultry. Suggestions generally possible now are preceded by an asterisk(*) .

Better control in feed and water is central to progress inasmuch as they can introduce salmonella at two key points: (1) contamination of livestock and poultry from birth to day of slaughter and (2) contamination of breeding stock and subsequent spread to progeny before delivery to growing farms.

1. Whenever possible or practical, obtain feed and feed components (for example, rendered products) from manufacturers with a certified program for the prevention and control of salmonella. Feed must be carefully protected against moisture and fecal contamination during storage and use on the farm.

Reasons: The important role played by feed in the introduction to and spread of salmonella among livestock and poultry is beyond doubt. It appears that a significant reduction in carcass contamination rate could be markedly enhanced by prevention and control of salmonella contamination of feed and drinking water.

Note: Recommendations for the prevention and control of salmonella in feeds and feed components have been developed by the Feed and Feed Ingredients Subcommittee of the Advisory Committee on Salmonella.

2. Whenever possible or practical, secure new livestock and poultry from breeding stock, hatcheries, and other sources conducting an active campaign for the prevention and control of salmonella.

Reasons: Transmission of salmonella from new herd and flock additions and from parents to their offspring does occur and can be a significant link in a chain of infection leading to the processing plant and beyond.

Note: Recommendations have been developed by the Breeders and Hatcheries Subcommittee of the Advisory Committee on Salmonella for the prevention and control of poultry breeder/hatchery infection. The U.S. Sanitation Monitored Program has been formulated recently by NPIP as a broad, national starting point for reducing incidence of salmonella in poultry-breeder flocks.

If proven safe and effective, the use of vaccines or normal gut micro-flora to block the colonization of salmonella in the intestinal tract may be considered as an adjunct to other recommendations.

- *3. Buildings for growing stock and assembly areas (such as sales barns) should be cleaned of all litter, debris and dust; and the entire interior (floors, walls, and ceilings) should be washed and disinfected by well-trained crews at least once yearly. Special attention should be given to the entry, feed, and other service areas, as well as to the feeders, watering devices, fan louvers or hanging equipment. EPA-registered disinfectants, such as cresylic acid or phenolics, should be used at label-approved strength. Floors need to be thoroughly soaked with cresylic acid or other disinfectants highly efficient in the presence of organic matter (see note). Disinfectants must be absorbed, set, or dried before reintroducing livestock and poultry.

Reasons: The housing and assembly environment can be a significant source of salmonella. Good disinfection has successfully reduced salmonella contamination. Hygienic husbandry at the growing-farm and transport levels will help reduce numbers of salmonella entering the processing plant.

Note: Dirt floors have reportedly been disinfected of salmonella by using a solution of formaldehyde (37 percent) diluted to one gallon to twelve gallons of water. This solution is applied as a spray, under low pressure, to floors at a rate of twelve gallons to 200-square feet. Concrete floors would need less formaldehyde solution for efficient disinfection. EPA label and OSHA clearance are needed before this technique can be fully recommended. Caution: Personnel should wear gas masks and protective clothing while applying formaldehyde solutions.

- *4. Buildings for total housing should be constructed and managed to minimize or eliminate direct or indirect contact with free-flying birds. The same security precautions are valid as concerns exposure to dogs, cats, rabbits, horses, barnyard fowl (such as bantams), waterfowl, game fowl, and other pet or pleasure animals. An environmentally safe, active rodent, pest, lesser meal worm or other bedding/litter infesting and free-flying insect control program is emphasized. The area adjacent to buildings and pens needs to be kept free from accumulated manure, rubbish and unnecessary equipment. The farm-manager must vigorously support and implement these growing-farm security practices.

Reasons: Free-flying birds, rodents, insects, pets, barnyard fowl, and other livestock can carry salmonella infection to growing stock. If managers do not appreciate the dangers of salmonella cross-contamination, the overall prevention and control effort will be seriously jeopardized.

- *5. No visitors should be allowed except under controlled conditions which insure sanitation. Exterminators, meter readers, salesmen, plumbers, fire-extinguisher inspectors, and others frequently move from farm to farm and walk through buildings. In addition, there are visits from children, managers, veterinarians, and feed or other delivery persons. Rubber boots should be disinfected before visitors enter and after they leave the buildings or pens. New, durable plastic boots may be worn and then disposed of immediately upon leaving. Coverall changes--using new or relaundered cloth coveralls or disposable ones (paper/plastic)--are encouraged. Used equipment from other sources should be disinfected before its movement onto growing-farms.

Reason: Salmonella can be transmitted through contaminated footwear, clothing, and equipment.

Note: Dead birds and animals should be disposed of in a hygienic manner.

When unusual losses occur, representative specimens should be taken to a diagnostic laboratory.

*6. Sampling and analysis to monitor effectiveness of the sanitation procedures are recommended. Sampling on a statistical basis rather than 100 percent can provide reasonable quality assurance. Consideration should be given to periodic representative sampling of: (1) feed and water, (2) newly delivered stock, (3) the housing and assembling environment after disinfection, and (4) growing-stock one week prior to slaughter. Culture results should be shared with those concerned with preparation, supply and/or utilization of materials sampled.

Reasons: Monitoring can identify problems if they exist and will aid in their prevention and correction. It provides a useful incentive factor and is also a means to measure progress. Salmonella negative herds and flocks could be slaughtered early on kill-day to aid the processor in contamination control.

Note: Cultural and serologic sampling procedures have been published by the American Association of Veterinary Laboratory Diagnosticicians, U.S. Animal Health Association, the National Poultry Improvement Plan, and the American Association of Avian Pathologists. Industry should encourage State and Federal agencies to expand salmonella testing, isolation, and serotyping services so industry can implement practical and effective monitoring programs.

7. Ranges should be rotated whenever possible. If this is not feasible, the range could be plowed and planted with a cover crop between growouts. Scraping and soil disinfection with formalin is reported to be an equally effective alternate procedure.

Reason: Range rotation, plowing, or disinfection can suppress reintroduction of infection from the soil.

8. Cleaning and sanitizing of transport crates and livestock carriers are needed, particularly if they have carried slaughtered livestock or poultry from infected herds or flocks. (Some modern poultry or small animal transport crates cannot be cleaned economically.)

Reason: Transport equipment moves from farm to farm. Therefore, it can serve as a vehicle for salmonella and other dangerous, infectious agents.

*9. Representative specimens from cases of diarrhea or post-natal disease should be submitted for veterinary laboratory examinations to detect and confirm clinical salmonellosis, if present. Livestock and poultry affected with salmonellosis should be segregated, whenever possible. Sources of the outbreak ought to be traced, identified, and removed.

Reasons: Prompt detection and judicious handling of salmonella outbreaks can prevent massive spread of high levels of contamination.

*10. The reduction of stress (such as crowding, temperature extremes, poor ventilation and long distance hauling) and provision of sound nutrition on the farm and during transport to slaughter are encouraged.

Reason: The salmonella carrier state can be altered by excessive stress or malnutrition resulting in markedly increased shedding of salmonella or actual clinical illness.

A coordinated approach involving essentially simultaneous application of at least suggestions 1, 2, and 3 offers the best promise to reduce salmonella in livestock or poultry shipped to processors.

E. Recommendation.

The Department should at least triple the current funding for research, field trials, and developmental projects on salmonella control at the farm and transit levels of livestock and poultry production.

Comment.

Support of intramural and extramural studies is necessary to enable implementation of economic control of salmonella at the growing-farm and transit to slaughter levels of livestock and poultry production. Subcommittee inquiries have found that budgeting for processing research versus farm/transit research is 3:1, 9:1 and 24:1 depending on source of information. The average ratio of 15:1 is inadequate considering the extremely important role of incoming livestock and poultry as the main source of introducing salmonellosis to processing plants.

PROCESSING

A. Recommendation.

Improvements should be made in the design of final washers on poultry-eviscerating lines by standardizing water pressure, nozzle type, location, and procedures.

Comment.

Studies verify that improved cleaning procedures can be realized both microscopically and macroscopically by prescribing minimum final wash standards. 2/

2/ ARS-S-27 A Final Bird Washer-Design Specifications and Evaluation. 1973.
W.K. Whitehair and Rex Childs. Russell Research Laboratory, Athens, GA.

B. Recommendation.

Processing water should be chlorinated at the final poultry wash (providing sufficient contact time) or in all chilling processes, or the total inplant poultry-processing water should be chlorinated at levels currently prescribed by the Department.

Comment.

The Committee recognizes pasteurization of dressed meat and poultry products as one of the most practical and effective methods for reducing salmonella. However, chlorination is the present method of choice, based on plant experience and final results. Other methods are proposed in the research section. Under no circumstances, however, would a pasteurization process be permitted as a substitute for good sanitary dressing procedures.

C. Recommendation.

Standardize and implement minimum training for plant employees emphasizing the reasons for sanitary handling of meat and poultry products. This is proposed to be done as a joint effort of industry and appropriate departmental training and other program officials.

Comment.

Generally, meat and poultry industry officials agree more could be done to train their employees in the importance of good sanitary handling practices. Rapid turnover of employees and short-term job assignments make this difficult but very important to accomplish.

D. Recommendation.

The meat and poultry industry should expand packaging operations so more products leaving processing plants are packaged in consumer-sized units.

Comment.

The Committee recognizes the advantages of packaging for consumers at the processing plant rather than the retail outlet. Obviously, plant-packaging would reduce possibilities for additional handling and transport contamination. The central commissary concept should enhance this effort.

E. Recommendation.

The Department should update current policies on handling raw and cooked meat and poultry products in the sample plant. Where physical separation does not occur, the Committee recommends a plan be developed assuring complete separation of raw and cooked processing activities.

Comment.

Cross-contamination of cooked with raw meat and poultry is the basic issue in all Committee recommendations.

F. Recommendation.

The Department should implement sequential inspection procedures on poultry lines prior to evisceration. This would allow time for condemned birds to be hung off the line for final disposition by inspectors.

Comment.

Sequential inspection procedures would prevent cross-contamination on the poultry evisceration line with birds that obviously would be condemned.

G. Recommendation.

The Department should study further procedures that would allow trimming of poultry carcasses near the end of the evisceration line instead of trimming at the inspection station.

Comment.

The Committee recognizes that this will require considerable study and that it departs from traditional inspection requirements. However, the concern is that cut surfaces may become contaminated during other line operations or cross-contaminated during the trimming operation.

H. Recommendation.

The red meat slaughtering industry should develop and implement chlorination procedures either at the final carcass wash (assuring sufficient process time) or during the chilling process. If the processor chooses to rework viscera that was accidentally contaminated during the dressing process, all such viscera and parts should be chlorinated as prescribed by the Department. In lieu of such procedures, the entire water supply used in connection with dressing procedures should be chlorinated. Other processes may be used as supported by additional research and acceptance by FDA.

Comment.

See comment under item B.

I. Recommendation.

Both meat and poultry processors should utilize automated cleaning equipment with proven effectiveness to the fullest extent possible, and they should work with equipment manufacturers in developing effective automated cleaning processes.

Comment.

Processors indicate that more uniform, predictable cleaning effectiveness

is possible with properly programmed automated cleaning equipment.

J. Recommendation.

Red meat and poultry processing guidelines should be developed by industry, providing priorities and implementation timeframes to procedures that would reduce the incidence of salmonella in routine processing of various meats.

K. Recommendation.

The Committee endorses the development of model ordinances covering food handling facilities, equipment, and practices in both wholesale and retail establishments.

CONSUMER EDUCATION

A. Recommendation.

The Department should support and emphasize the importance of the reduction of salmonella in all parts of the food chain.

Comment.

The consumer should be made aware of the steps taken by the producer, the processor, and USDA to lessen contamination. Especially of concern is the final preparation and/or serving of food in the home, mass feeding outlets, and retail food outlets. The proper handling of meat and poultry by the consumer should be stressed in programs of education. The USDA/ERS study^{3/} has identified those groups in greatest need of such information.

B. Recommendation.

The Department should increase the use of mass media for dissemination of food safety information to consumers:

1. Use single concepts for high impact in television and radio spots. The two most important concepts are (1) time and temperature for proper storage of food and (2) proper handling to prevent cross-contamination from raw to cooked food.
2. Use pamphlets and special articles with more detailed information on the "whys" of proper food handling for magazines and newspapers and for indepth programs for radio and television. Practical, safe food-handling tips should also be included in recipe books.

^{3/} Food Safety: Homemakers' Attitudes and Practices. USDA/ERS Ag. Econ Rep. 360.

Comment.

The USDA/ERS study shows that 78 percent of the homemakers interviewed were not aware of, or were unconcerned about, cross-contamination and leaving cooked meat at room temperature for more than 2 hours. Television, food labels, newspapers, and magazines were identified by the homemakers interviewed in this same study as the best way to get food safety information.

C. Recommendation.

Food scientists, microbiologists, home economists, and social scientists should be included as advisors, and encouraged to actively participate in the development of educational materials and mass media efforts. These professionals are available in the concerned governmental agencies, USDA and USPHS, Center for Disease Control; in the poultry and meat industry; and in universities and colleges. Close communication and cooperation among these groups are recommended.

Comment.

Resource persons meeting with the subcommittee emphasized the difficulty of communicating food safety information to an audience which, for whatever reason, is uninterested. The social aspect of such messages must be considered in order to maximize understanding. These observations confirmed the experience of members of the subcommittee.

D. Recommendation.

The Department should encourage legislation requiring certification of food service managers.

Comment.

The food protection program sponsored by the National Institute for the Food Service Industry, Chicago, is the basis for such certification in states and communities where certification is mandatory. The USDA/ERS study has identified food-handling errors made by homemakers. According to investigations made by the Center for Disease Control, the same food-handling errors are made by food-service personnel and have resulted in large foodborne illness outbreaks.^{4/}

E. Recommendation.

To avoid duplication of efforts and develop uniformity of information, a list of organizations which conduct seminars and courses in food handling and food hygiene should be compiled. A list of educational material available from governmental agencies, the food industry, supermarkets, and the restaurant industry should also be compiled.

^{4/} Microbiological Food Hazards Today - Based on Epidemiological Information, F. L. Bryan, Food Technology, September 1974.

Comment.

Information about USDA leaflets which can be obtained "camera-ready" should be disseminated to food companies and others who could use them. A list similar to the one recommended was published in Poultry Science, Vol. 54, 1975, by Dr. G. Schuler.

F. Recommendation.

USDA should develop individually packaged educational programs on food safety for the following:

- a. Elementary schools.
- b. High schools.
- c. Colleges.
- d. Adult education programs.
- e. Food-handling firms.
- f. Retail food stores.
- g. Distribution centers.

Comment.

Packaged programs would allow teachers of consumer education, hygiene, and other courses to easily incorporate food-handling practices as part of a more comprehensive course.

G. Recommendation.

USDA should encourage increased reporting of individual cases and outbreaks of salmonellosis and other foodborne illnesses to the USPHS, Center for Disease Control.

Comment.

Increased reporting will aid in the education of consumers and other food handlers and serve as a benchmark for assessing the success of a food safety education program.

RESEARCH

A. Recommendation.

Research should be implemented to identify the specific parameters of time, temperature, moisture, and pressure necessary in pelleting and extruding operations to reduce salmonella to nondetectable levels.

Comment.

Considerable amounts of feed are presently pelletized. The results to date have been variable but it has been claimed that slight modification in processing can result in significant reduction in salmonella and other microbial organisms. The Committee believes that feed is perhaps the single most important source of salmonella contamination in livestock and poultry and, therefore, research in this area should be a matter of considerable urgency.

B. Recommendation.

Identify antibacterial agents for salmonella that can be used in feed and feed ingredients. Special emphasis should be given to the use of formaldehyde.

Comment.

Chemical additives to feed and feed ingredients appear to be the most practical method of controlling the spread of salmonella in poultry. Formaldehyde has been used for many years in controlling bacterial contamination in eggs. Studies by USDA and certain renderers indicate that formalin is effective in reducing salmonella contamination in rendering plants. The Committee suggests that a survey should be made of the work that has been done on formalin as an antibacterial agent, and this data should be reviewed and evaluated by an expert panel. If no further research is indicated, the data should be submitted to FDA in the form of a petition for approval as a feed additive.

C. Recommendation.

Research should be directed toward developing a rapid test to identify the presence of salmonella in feed and feed ingredients. Research should be concentrated on finding a test that will significantly reduce the time for pre-enrichment and enrichment techniques.

Comment.

A program that is directed toward reducing the incidence of salmonella contamination in raw meat and poultry will require continual monitoring and surveillance in many different areas. Quick identification or presumptive tests will be important in identifying additional sources of salmonella contamination. Such tests could also apply to the surveillance program recommended for poultry and meat at the processing plant.

D. Recommendation.

Studies should be made to determine the effect of stress factors on animal physiology and to determine how these stress factors can be minimized by either changes in handling practices or conditioning of

the animal.

Comment.

Several studies, in particular those involving pigs, have shown the importance of animal stress on the excretion of salmonella. There is little doubt that stress factors contribute greatly to the increase in number of salmonella excretors from the farm, through transport and holding, to the carcass at the abattoir. These stress factors have been identified or are presumed to be:

- a. Crowding and mixing of producer lots on trucks.
- b. Lack of air movement on lower levels of multiple-decker trucks, leading to reduced oxygen, elevated carbon dioxide, and elevated temperatures.
- c. Poorly designed holding pens which hinder easy movement of animals and are difficult to clean and sanitize between lots.
- d. Extended periods of holding without feed, fresh water, and adequate ventilation.

Little is known about how these and other stress factors affect the physiology of the animal and why these physiological aberrations trigger an increase in shedding of salmonella.

E. Recommendation.

Additional research should be done on the use of chlorine in reducing salmonella contamination of poultry and red meat carcasses. The work should be designed to obtain optimum parameters of chlorine level, volume of wash water, pH and type of acidulant, temperature of wash water and carcass, application pressure and synergism between chlorine and other halogens, such as bromine.

Comment.

It is an established fact that chlorine, even in very low concentrations, is bactericidal to salmonella when used in aqueous systems or applied to equipment which are free of organic matter. Contact with fats and proteins, as would be the case in poultry and red meat processing facilities, results in consumption of available chlorine and a reduction in bactericidal activity. The degree to which bactericidal activity is lost appears dependent upon the type and amount of organic matter present, the formation of secondary disinfectants such as chloramines, the type of chlorine compound, and basic factors of pH and temperature.

Because of the multiple factors involved, there is much disagreement in published literature on the effectiveness of chlorine in reducing surface contamination of poultry and red meat carcasses. The fact that

some researchers have found chlorine to be effective as a carcass sanitizer--while others have reported little or no effect--is an indication that the action of chlorine in the presence of organic matter is not well understood.

F. Recommendation.

Other methods of pasteurization, such as heat and irradiation, should be considered as a means of reducing salmonella and other microbial contamination on animal carcasses, raw meat and poultry.

Comment.

The Committee recognizes that although the industry has had its most experience with chlorination, other methods of pasteurization should not be overlooked in planning future research.

G. Recommendation.

USDA should establish a team of epidemiologists to investigate human outbreaks of salmonellosis attributed to consumption of livestock and poultry products.

Comment.

The team should consist of individuals familiar with the many aspects of meat processing as well as modes of contamination, survival, and growth of salmonella in meat products and the processing environment. If necessary, consultants should be used to augment the team. Success in investigating outbreaks is dependent upon prompt reporting of outbreaks by local and state health agencies to an established contact person within USDA.

The benefit of indepth investigation of outbreaks is the information gained. This information would guide USDA in their effort to develop meaningful regulations that would prevent future outbreaks. Inspectors in the plant would become more cognizant of critical control points in meat processing. Where it is established that the products are mishandled after the products have left an inspected establishment, USDA should further its educational efforts making reference to the specific causes of the mishandling.

H. Recommendation.

A study should be made to determine the relationship between proposed sampling plans and prevention of foodborne illness.

Comment.

Several approaches to sampling meats have been proposed for the purpose of establishing microbiological criteria for meats. One reason which

has been given in support of the need for microbiological criteria is prevention of foodborne illness. A study should be made to determine (1) whether microbiological criteria will have an impact on foodborne illness and (2) which of the proposed sampling plans is best suited to accomplish this purpose.

I. Recommendation.

Federal funds should be made available for both intramural and extramural research, field trials, and developmental studies on salmonella control in live animals and poultry.

Comment.

These studies should include (1) the current incidence of herd and flock infection and (2) the feasibility of producing "salmonella-clean" flocks and herds by application of the best practical control methods of the livestock and poultry industry.

APPENDIX A

UNITED STATES DEPARTMENT OF AGRICULTURE
Office of the Secretary
Washington, D.C. 20250

November 12, 1975

SECRETARY'S MEMORANDUM NO. 1886

Advisory Committee on Salmonella

This memorandum establishes the Advisory Committee on Salmonella. This Committee is needed to study and eliminate salmonella organisms. The establishment of the Committee is in the public interest in connection with the duties imposed on the Department by law.

Duties of the Committee include: studying measures to reduce the incidence of Salmonella organisms in live birds and animals, and to limit the spread of Salmonella contamination during slaughtering, eviscerating and further processing operations; recommending and soliciting the cooperation of affected industries in implementing measures developed; recommending regulatory requirements needed to apply critical control procedures; and considering means of disseminating information on preventative practices to all segments of the industrial operations and homemakers.

The objective of the Committee will be to reduce the incidence of Salmonella in humans, animals and poultry.

The Chairman of the Committee will be the Assistant Secretary for Marketing and Consumer Services to whom the Committee will report. The Administrator of the Animal and Plant Health Inspection Service (APHIS) will serve as Vice Chairman, and the Director of the Technical Services Staff, Meat and Poultry Inspection Program, APHIS, will serve as Executive Secretary. APHIS will supply the necessary Committee support.

The Committee will be comprised in part of representatives from the meat and poultry producing and processing industries, feed suppliers, renderers, members of the academic community, and other government agencies.

Plans call for the Committee to meet quarterly, and the estimated annual costs are \$25,000 including 0.3 man-years of staff support.

Termination of the Committee will be 2 years from the date of this memorandum, and members of the Committee will be appointed by the Secretary.

This memorandum also serves as the Charter for the Committee.

J. Phil Campbell

J. PHIL CAMPBELL
Acting Secretary

APPENDIX B

Advisory Committee on Salmonella

In addition to the assignments made by the Secretary in the charter for APHIS personnel and their designees, the Secretary appointed the following members:

Dr. William B. Bixler, Chief, Medicated Feed Branch, Food and Drug Administration, U.S. Department of Health, Education and Welfare, Rockville, MD

Dr. Harold J. Buyens, Director of Operations, Swift and Company, Chicago, IL

Dr. Morris S. Cover, Director, Veterinary Services and Regulatory Department, Ralston Purina Company, St. Louis, MO

Dr. Robert C. deBaca, Consultant, Livestock Program Development, Ames, IA

Dr. William M. Dungan, Director of Veterinary Medicine, Nicholas Turkey Breeding Farms, Inc., Sonoma, CA

Dr. Harry W. Hays, Staff Scientist, Marketing, Nutrition, and Engineering, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, MD

Dr. W. M. Hill, Food Microbiologist, Armour Foods, Oakbrook, IL

Mrs. Margaret Huston, Scientific Director, Poultry and Egg Institute of America, Chicago, IL

Dr. Conwell Johnson, Director, Product Development, National Renderers Association, Des Plaines, IL

Mr. Vrem Levins, Bruce Milling Corporation, Prairie Village, KS

Dr. Edward T. Mallinson, Chief, Avian Health Division, Bureau of Animal Industry, Pennsylvania Department of Agriculture, Harrisburg, PA

Dr. Kenneth N. May, Vice President for Corporate Research and Quality Assurance, Holly Farms, Wilkesboro, NC

Ms. Dorothy Teater, Consumer Affairs Office, Columbus, OH

Dr. William P. Williams, General Production Manager, Cargill, Inc., Minneapolis, MN

Dr. George Wilson, Corporate Director for Manufacturing Services, Hygrade Food Products, Southfield, MI

Dr. George E. York, Food Technologist, University of California, Davis, CA

APPENDIX C

Expert Advisors to the Advisory Committee on Salmonella

Dr. W. Adams, Georgia Poultry Improvement Association, Oakwood, GA

Mr. William Albrecht, Eastern Research Laboratory, Athens, GA

Dr. G. W. Albright, Showell Poultry Company, Showell, MD

Dr. Robert Angelotti, USDA, Washington, DC

Dr. H. D. Anthony, Kansas State University, Manhattan, KS

Dr. Royal Bagley, Moroni Turkey Hatchery, Moroni, UT

Dr. Robert Ball, Babcock Poultry Farm, Ithaca, NY

Dr. Charlie Beard, Eastern Research Laboratory, Athens, GA

Mr. Steven R. Beckley, National Pork Council, Des Moines, IA

Ms. Barbara Beizer, National Consumers Congress, Washington, DC

Dr. Art Bickford, University of California, Davis, CA

Dr. B. O. Blackburn, Veterinary Services Laboratory, APHIS, USDA, Ames, IA

Dr. Roy Blankenship, Eastern Research Laboratory, Athens, GA

Mr. Lee Boyd, American Feed Manufacturers Association, Arlington, VA

Dr. H. Brandt, Foster Farms, Livingston, CA

Dr. R. Burdett, State Department of Agriculture, Salem, OR

Dr. A. B. Childers, Texas A&M University, College Station, TX

Mr. R. Cobb, Cobb Incorporated, Concord, MA

Dr. Mitchell Cohen, Center for Disease Control, Atlanta, GA

Mr. Nelson A. Cox, Eastern Research Laboratory, Athens, GA

Dr. Frank R. Craig, Perdue Farms, Inc., Salisbury, MD

Dr. Donald E. Davis, Simmons Industries, Inc., Siloam Springs, AR

Dr. Robert Deibel, Department of Bacteriology, University of Wisconsin, Madison, WI

Dr. W. T. Derieux, Clemson University, Clemson, SC

Dr. Charles Deyoe, Department of Grain Science, Kansas State University, Manhattan, KS

Dr. Jack Douglas, Gold Kist, Inc., Atlanta, GA

Ms. Mona Doyle, Director of Consumer Affairs, Food Fair Stores, Philadelphia, PA

Mr. Bruce Duncan, Swift and Company, Chicago, IL

Mr. John Dupps, The Dupps Company, Germantown, OH

Dr. Gary Edwards, Wayne Poultry, Allied Mills, Chicago, IL

Mr. J. Burton Eller, Jr., American National Cattlemen's Association, Washington, DC

Dr. E. M. Ellis, 6912 S. Shore Drive, South Pasadena, FL

Dr. Robert Fontaine, Colorado Health Department, Denver, CO

Dr. Monte Frazier, Arbor Acres, Inc., Glastonbury, CT

Dr. Damien Gabis, Silliker Laboratories, Chicago, IL

Dr. Eugene Gangarosa, Center for Disease Control, Atlanta, GA

Mr. Spencer Garrett, Laboratory Director, Department of Commerce, Pascagoula, MS

Dr. R. F. Gentry, Wiley Laboratory, Pennsylvania State University, University Park, PA

Dr. H. G. Geyer, Extension Service, ANR-EP-USDA, Washington, DC

Dr. Len R. Harrison, BAI Laboratory, Pennsylvania Department of Agriculture, Harrisburg, PA

Dr. John Harvey, Professional and Consumer Programs, FDA, Rockville, MD

Mr. Edward Herman, Koppers Company, Inc., Muncy, PA

Dr. John B. Herrick, Extension Veterinarian, Iowa State University, Ames, IA

Dr. Alex Hogg, Extension Veterinarian, University of Nebraska, Lincoln, NE

Dr. L. H. Horne, Swift and Company, Chicago, IL

Dr. Charlie Howe, Hy-line International, Des Moines, IA

Dr. Walter F. Hughes, Olson Farms, North Hollywood, CA

Dr. Harold D. Hutchinson, Moorman Manufacturing Company, Quincy, IL

Mr. Ralph Johnston, Scientific Services, FSQS, Washington, DC

Jody Jones, Economic Research Service, USDA, Washington, DC

Mr. Joe Jones, Holly Farms Inc., Wilksboro, NC

Dr. R. W. Keirs, Peterson Industries, Decatur, AR

Dr. Daryl King, Veterinary Services, APHIS, Washington, DC

Dr. G. Kolb, Cuddy Farms, Strathray, Ontario, Canada

Dr. Anthony Kotula, ARS, Beltsville, MD

Dr. M. C. Kumar, Mile High Turkey Hatchery, Longmont, CO

Mr. E. J. Lawless, Bureau of Foods and Chemistry, Pennsylvania Department of Agriculture, Harrisburg, PA

Dr. John Lancaster, Agriculture Canada, Ottawa, Ontario

Dr. R. H. McCapes, University of California, Davis, CA

Dr. J. R. McDowell, Division of Animal Feeds, Food and Drug Administration, U.S. Department of Health, Education and Welfare, Rockville, MD

Dr. Alfred Mercuri, Eastern Research Laboratory, Athens, GA

Dr. R. Mitchell, H&N Inc., Griffin, GA

Dr. James F. Mock, Whitmoyer Laboratories, Inc., Horsham, PA

Dr. Earl Montgomery, Foreign Programs, MPI, Washington, DC

Dr. George Morris, Center for Disease Control, Atlanta, GA

Dr. Erskine Morse, Handley Professor, Purdue University, West Lafayette, IN

Robert Norton, Director, APHIS Information, Washington, DC

Dr. Satish C. Nivas, University of Minnesota, St. Paul, MN

Dr. William C. Patterson, Assistant Area Director, Richard B. Russell Agricultural Research Center, Athens, GA

Dr. G. W. Peterson, Foster Farms, Delhi, CA

Dr. Irvin Peterson, Veterinary Services, APHIS, USDA, Hyattsville, MD

Mr. Howard Phillips, C and R Duck Farms, Inc., West Hampton, L.I., NY

James Pierce, Milk Specialties Company, Dundee, IL

Dr. Ben Pomeroy, University of Minnesota, St. Paul, MN

Dr. Peter Poss, Earl Olson Farms, Willmar, MN

Dr. H. G. Purchase, National Program Staff, Beltsville, MD

Dr. D. Rahn, Jerome Food Inc., Barron, WI

Dr. R. A. Robinson, Associate Professor, University of Minnesota, St. Paul, MN

Dr. Reed Rumsey, Agriculture Research, Inc., DeKalb, IL

Dr. T. S. Sandhu, Cornell University, Duck Research Laboratory, Eastport, L.I., NY

Mr. Raymond Schar, National Poultry Improvement Plan, Agricultural Research Service, Animal Pathology Lab, Beltsville, MD

Dr. John Silliker, Silliker Laboratories, Carson, CA

Dr. Donald L. Singletary, Victor F. Weaver, Inc., New Holland, PA

Dr. Glen Snoeyenbos, University of Massachusetts, Amherst, MA

Mr. H. Donald Summers, Association of American Railroad, Washington, DC

Dr. R. B. Tompkin, Swift and Company, Oakbrook, IL

Mr. James Thompson, Eastern Research Laboratory, Athens, GA

Dr. John Walker, Veterinary Services, APHIS, Hyattsville, MD

Dr. Daniel Wenger, Central Soya, Decatur, IN

Mr. Carl Weston, Hubbard Farms, Walpole, NH

Dr. J. E. Williams, Eastern Research Laboratory, ARS, Athens, GA

Dr. Robert Winslow, Safeway Stores, Inc., Oakland, CA

Dr. Donald Zander, H&N Farms, Redmond, WA

Dr. Bernard Zecha, USDA, Denver, CO



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